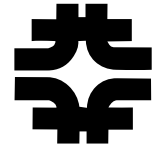


NEW Booster
ORBUMP
&
Corrector Magnets

Jim Lackey
Proton Source / Booster
Fermilab
March 29, 2005

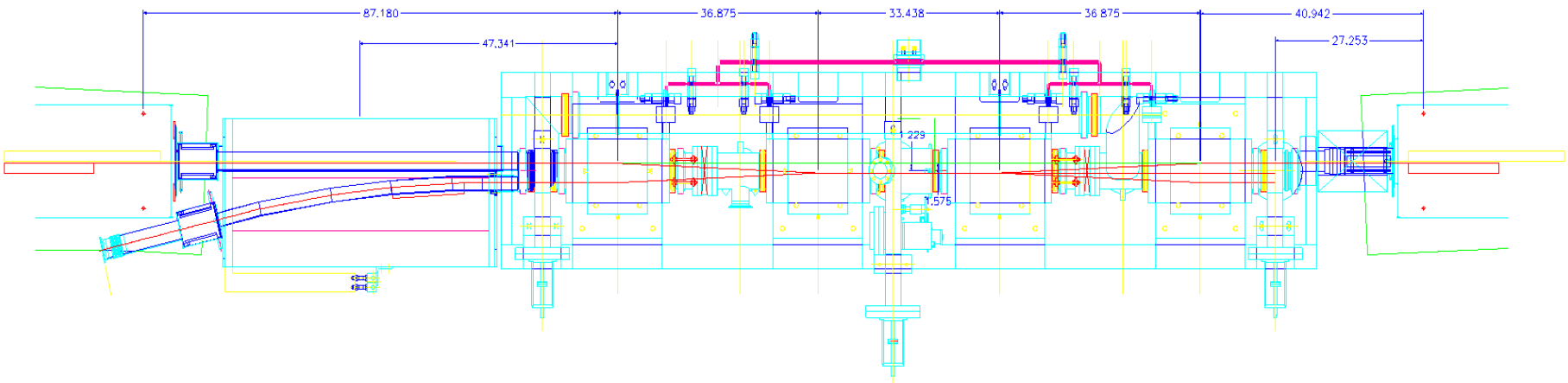
OUTLINE

- Status of the Injection Orbit Bump Magnets -- ORBMPS
- Status of the New Corrector Magnets

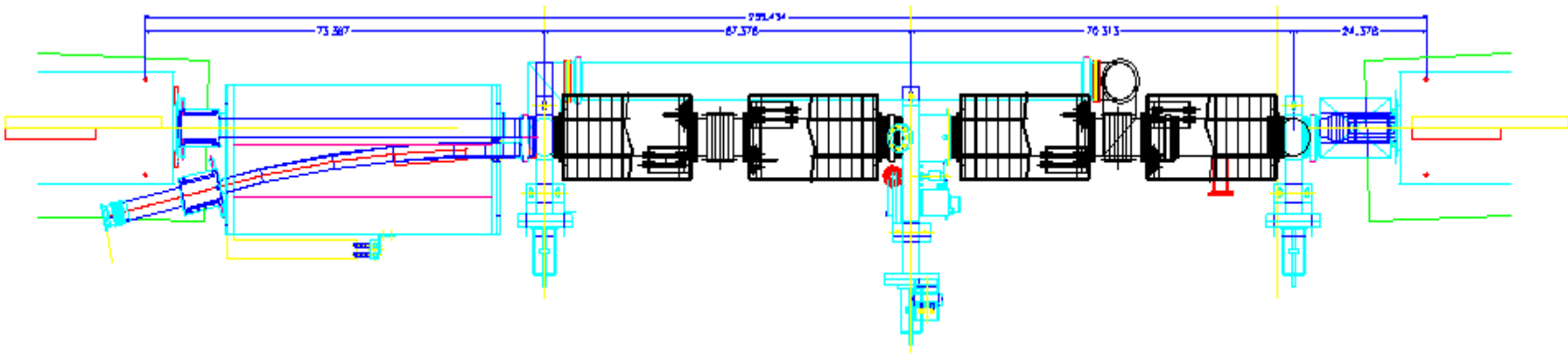
ORBMPS

- Operational ORBMPS
  - Designed to run at 15 kA max, 300 A_{rms},
  - 20% duty factor. NO cooling.
  - Presently running at ~50% duty factor.
  - Heating, Injection Error, Sextupole, Radiation damage.
- New ORBMPS
  - Designed to run at 15 kA max, 1500 A_{rms},
  - 100% duty factor. ~16% Stronger.
  - Built with ferrite and coil cooling.
  - Radiation hardened construction.
  - Fit in the same footprint as existing magnets.
  - New Power Supply

Present Injection Layout

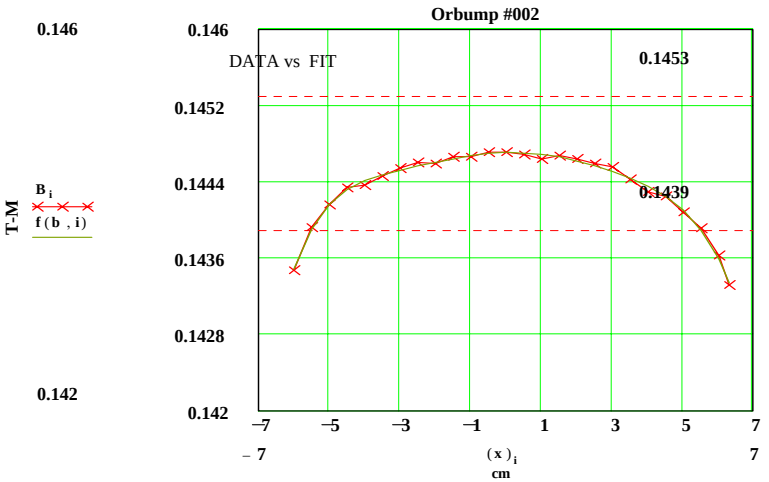


NEW Layout



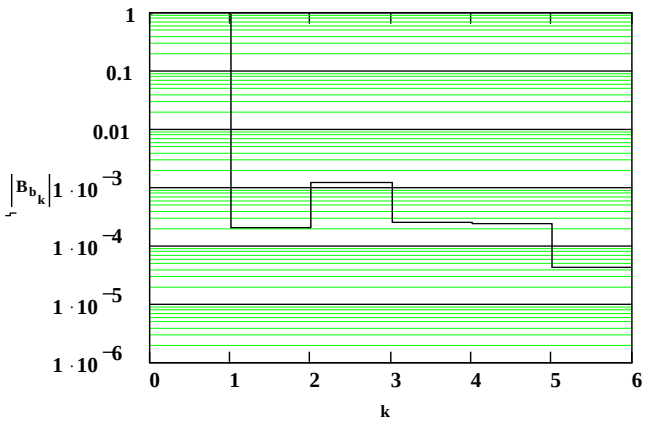
FIELD MEASUREMENTS

OLD



FIELD COMPONENT MAGNITUDES AT 1 inch.

$X := 2.54 \qquad B_{b_k} := \frac{b_k}{b_0} \cdot X^k$

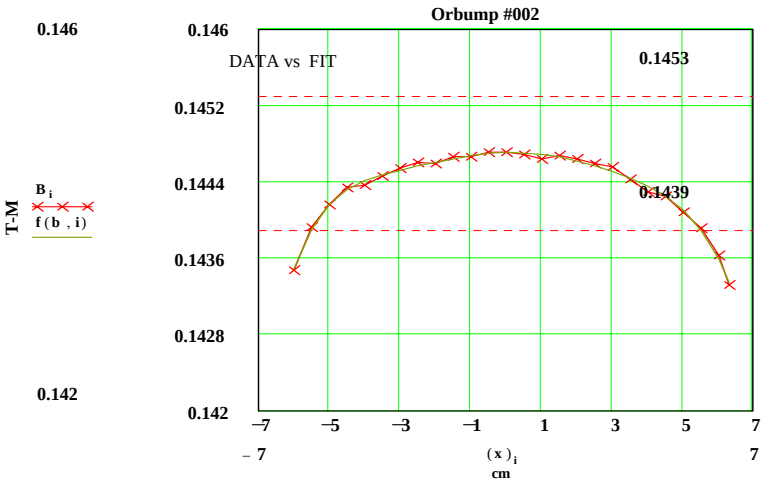


$B_{b_k} =$

1
2.0774914·10 -4
-1.1791958·10 -3
-2.4509892·10 -4
2.3808911·10 -4
4.2250924·10 -5
-5.1247301·10 -5

FIELD MEASUREMENTS

OLD



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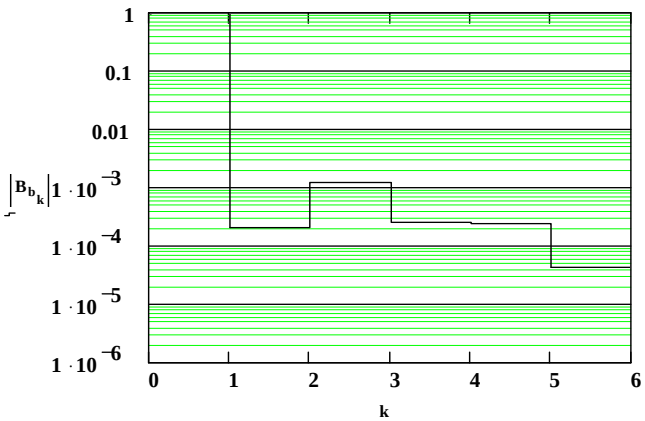
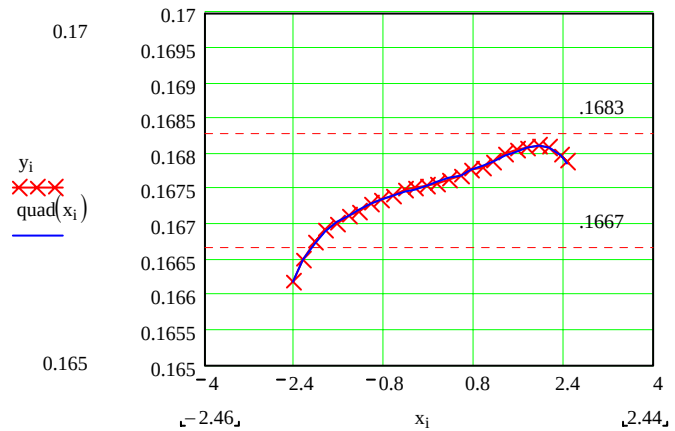


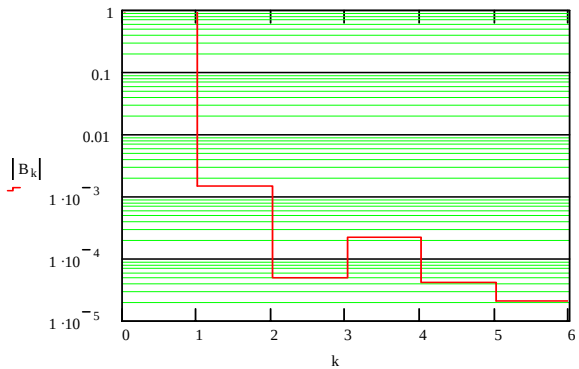
$B_{b_k} =$

1
2.0774914·10 -4
-1.1791958·10 -3
-2.4509892·10 -4
2.3808911·10 -4
4.2250924·10 -5
-5.1247301·10 -5



FIELD COMPONENT MAGNITUDES AT 1 inch.

$X := \frac{25.4 \cdot 1}{25.4} \qquad B_k := \frac{b_k}{b_0} \cdot X^k$



$B_k =$

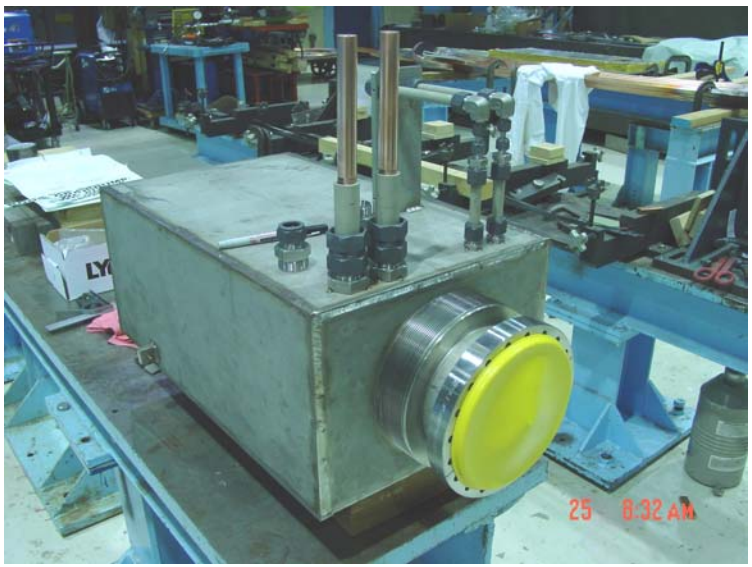
1
1.435·10 -3
4.782·10 -5
2.173·10 -4
4.005·10 -5
-2·10 -5
-2.297·10 -5

PHOTOS

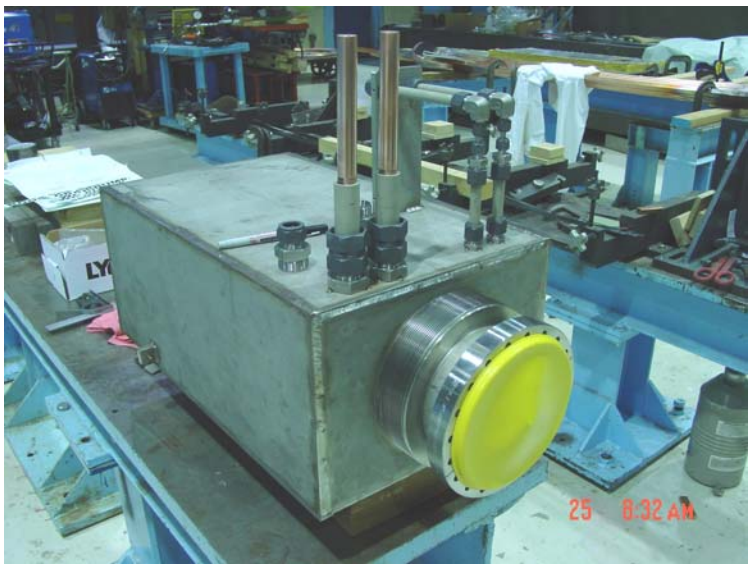
PHOTOS

PHOTOS

PHOTOS



PHOTOS



Present Status

Prototype #001 complete

Fields measured.

Has vacuum leaks, these are fixable.

DC field measurements to be done

at MTF.

#002 and #003 could be complete

within 2 weeks. Work stopped

pending coil modification to reduce

quad gradient.

Without modifications #005 by end of May.

Booster Corrector Magnets

- REPLACE old trims with ::
- Stronger fields
- Faster ramping capability
- Include sextupoles, normal and skew

Conceptual Design

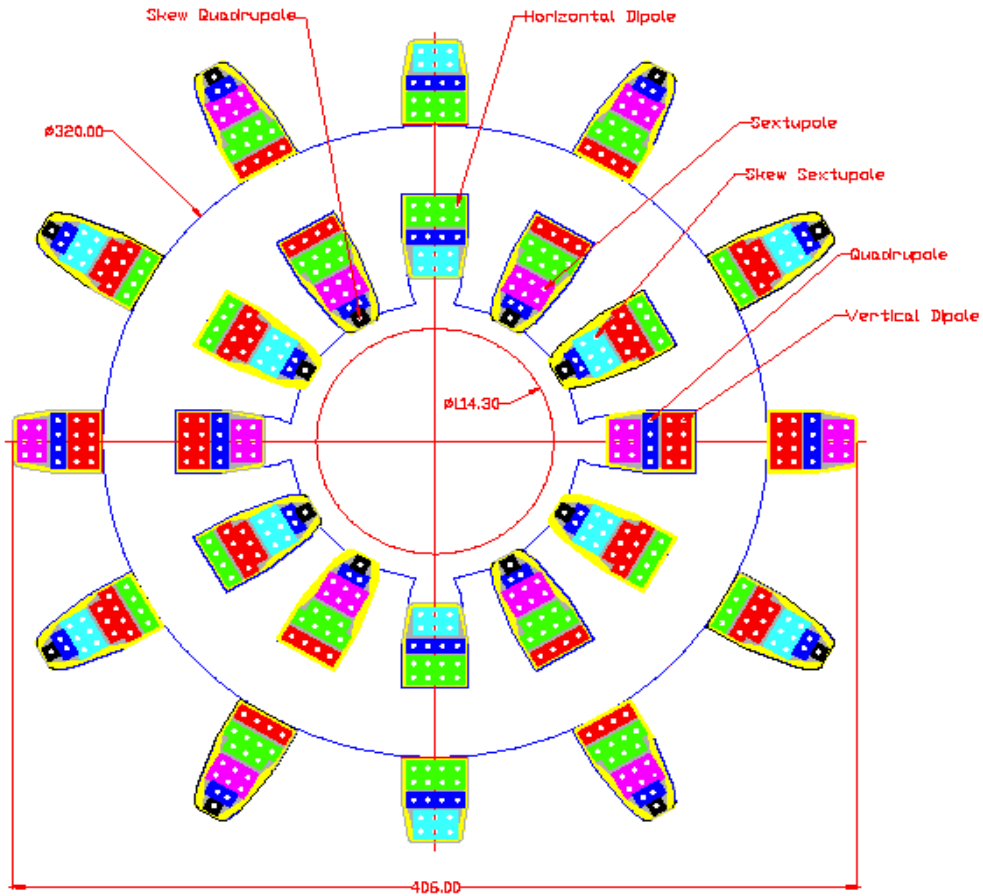


Fig. 1. Magnet cross-section

The Core

Fig. 2. Number of turns in the slots

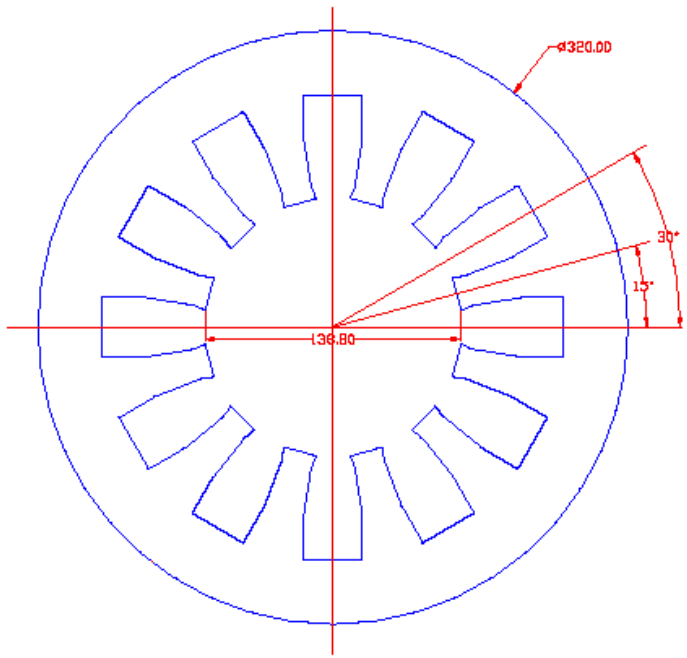


Fig. 3. The iron yoke cross-section

Dipole Fields

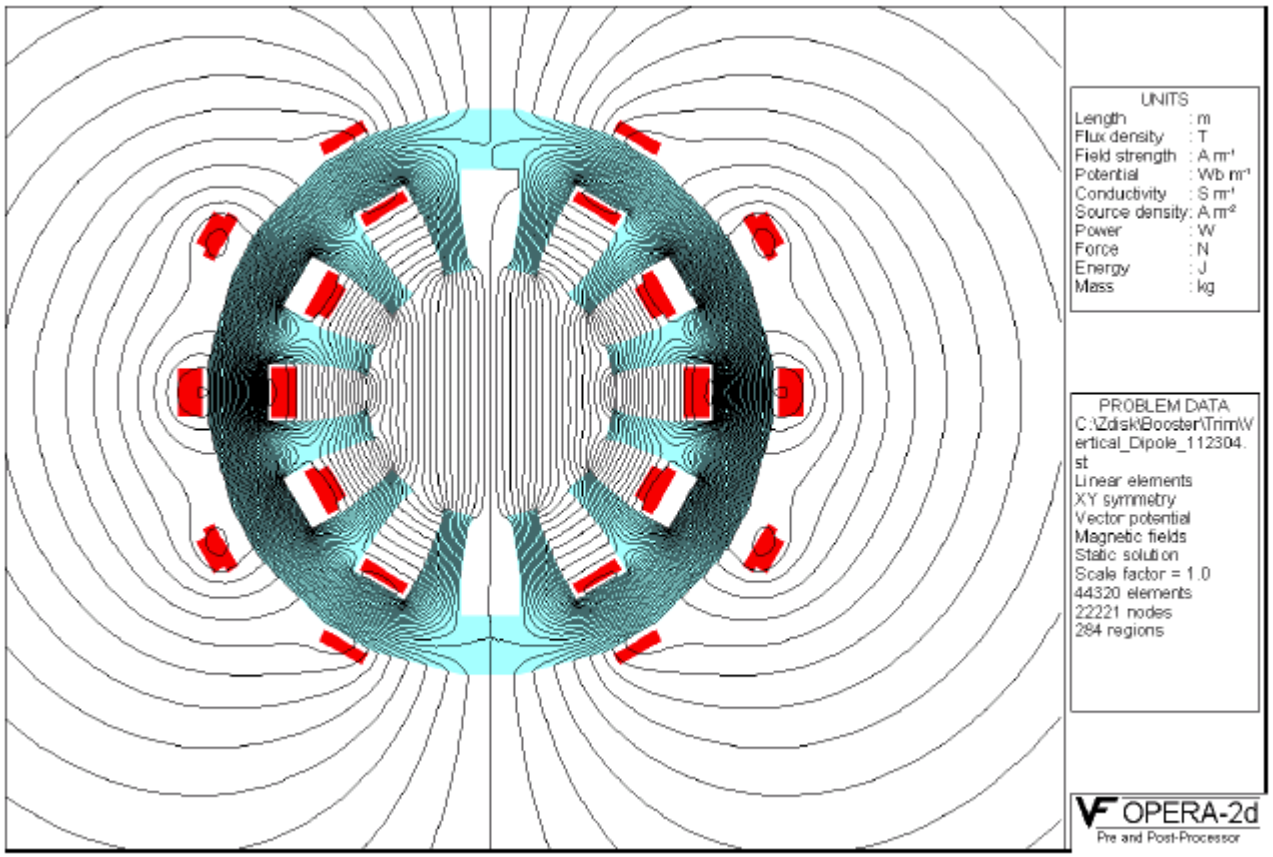


Fig. 5. The vertical dipole flux lines.

Quadrupole Fields

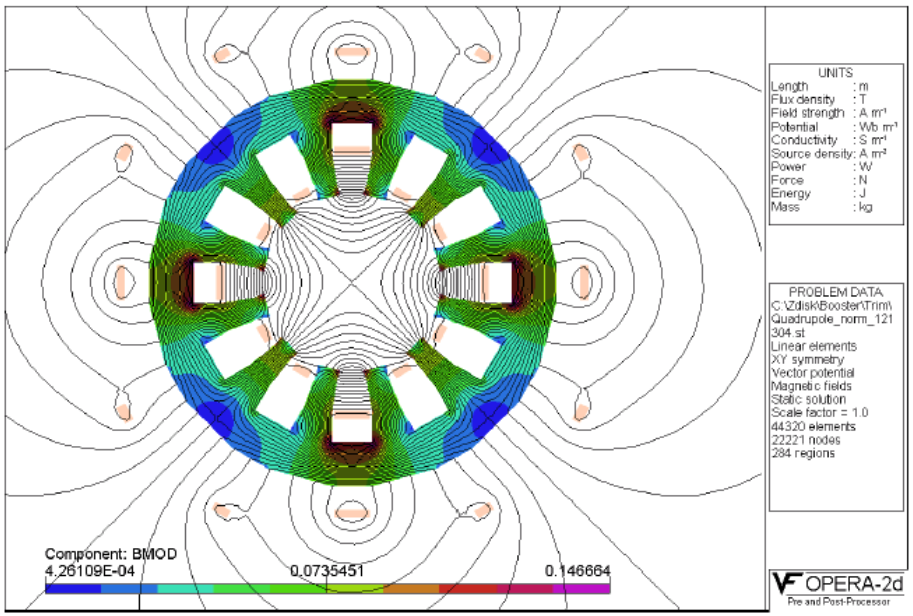


Fig. 7. The normal quadrupole flux lines and flux density.

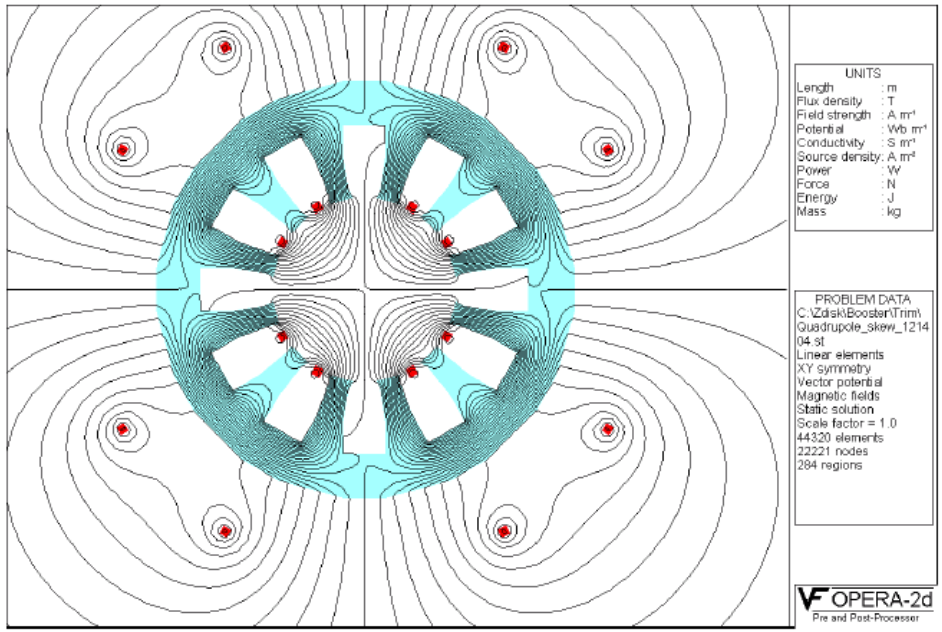


Fig. 8. The skew quadrupole flux lines.

Sextupole Fields

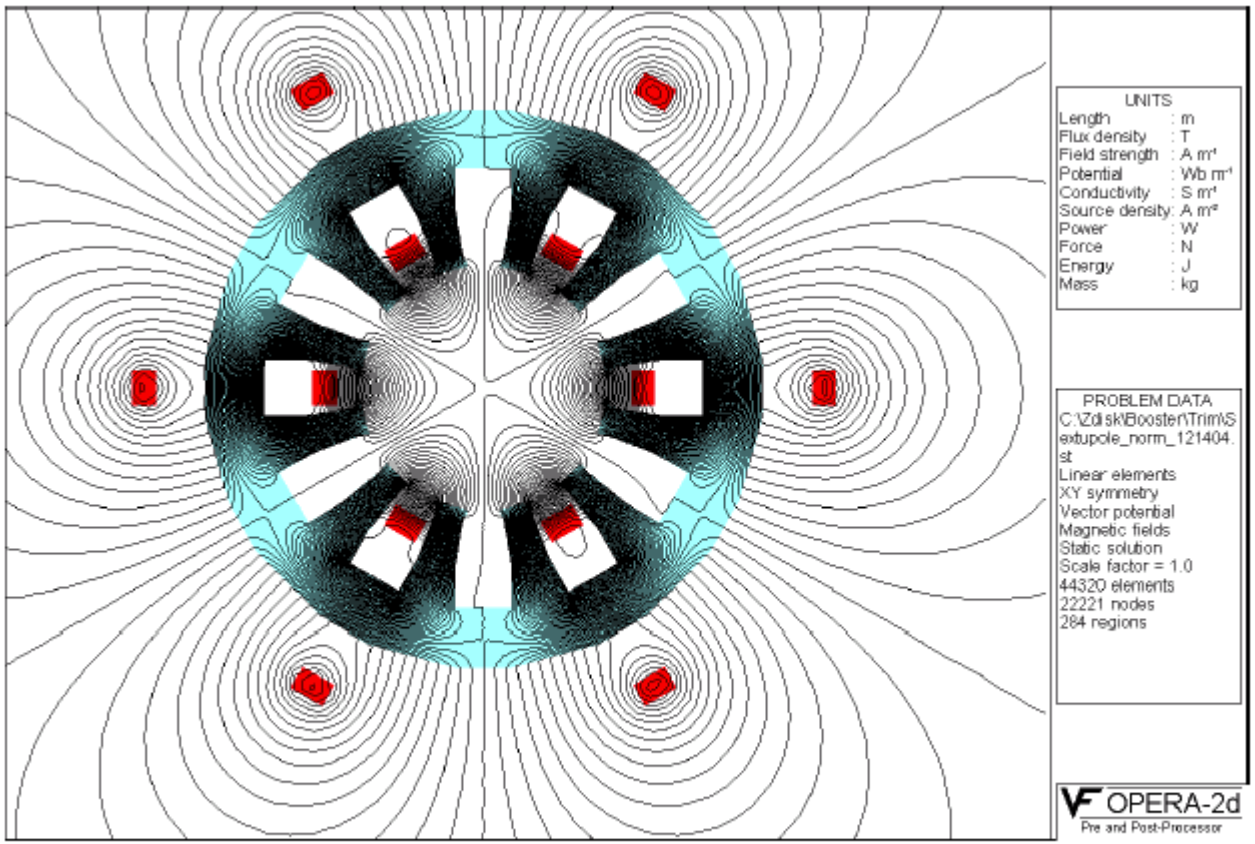


Fig. 10. The normal sextupole flux lines.

Field Strengths

Type	Max. Field (B,B',B")L	Max. Slew Rate	Strength Increase
Horizontal Trim	0.009 T-m	0.5 T-m/s	x1
Vertical Trim	0.015 T-m	0.8 T-m/s	x2.8
Quadrupole	0.08 T-m/m	160 T-m/m/sec	x1.8
Skew Quadrupole	0.008 T-m/m	0.8 T-m/s	x1
Sextupole	1.41 T-m/m^2	2.8e3 T-m/m^2/sec	x1

Table 1

Status

- A new coil design has been completed to reduce the peak current from 200A to 50A. This matches nicely with the MI 50A trim power supply.

- The new coil designs must be tested for cooling.

- 3/21/05 Test winding and curing fixtures are being fabricated to practice winding techniques. An aluminum core mock-up is also being fabricated to test mount the resultant coils.

- First prototype to MTF early September.